Textbook of Oral and Maxillofacial Surgery

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Chapter 25

Salivary glands and ducts

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Structure of the Salivary Glands

Salivary glands may be divided for purposes of description into major and minor glands. The major salivary glands are the parotid, submandibular, and sublingual glands. The minor salivary glands are those smaller glands and groups of glands in the palate, buccal mucosa, and floor of the mouth that secrete primarily mucus. Since the salivary glands have frequently been described in detail in various texts on anatomy, histology, and surgery, this discussion is limited to such descriptions as are pertinent to oral surgical problems.

Gross anatomy

Parotid gland. The parotid gland is a paired, bilobular serous gland overlying the masseter muscle. It extends upward to the level of the auditory canal and downward to, and frequently below, the lower border of the mandible. Posteriorly it wraps itself around the posterior border of the mandible, and anteriorly it extends into the buccal fat pad, where it gives off its excretory duct. In the fat substance a small lobule of gland usually attaches itself to the duct. The superficial lobe and the deep lobe are connected by an isthmus at the posterior border of the gland.

The motor portion of the seventh cranial, or facial, nerve emerges from the stylomastoid foramen and passes laterally and anteriorly to the isthmus, where it divides into two main branches. These branches pass above and below the isthmus between the lobes, branching and rejoining along their course. Thus the seventh cranial nerve is deep to the superficial lobe of the parotid gland and passes between the lobes rather than within the parotid substance. As a result, it is possible to remove the superficial lobe without sectioning the nerve.

The parotid duct passes anteriorly and medially from the gland along the lateral border of the masseter muscle and turns at a right angle around the anterior border of the masseter muscle. It then penetrates the buccinator muscle and the oral mucosa and opens, at the level of the neck of the maxillary second molar, into a small caruncle. Thus from 1.5 to 3 cm of the duct is accessible from the mouth. Dissection through the mouth past the right angle turn at the anterior border of the masseter muscle is most difficult; and an element of risk is present, since portions of the seventh cranial nerve may be encountered at this level.

Submandibular gland. The submandibular gland is a paired mucoserous gland lying in the submandibular space. It extends inferiorly to the digastric muscle, superiorly to the

mylohyoid muscle, anteriorly to the midbody of the mandible, and posteriorly to the angle of the mandible. It is bordered laterally by the medial border of the mandible and medially by the hyoglossus muscle. Inferolaterally it is covered by the skin and platysma muscle.

At the posterior border of the mylohyoid muscle the submandibular gland turns up and forward, entering the sublingual space and giving off its excretory duct. The duct passes anterosuperiorly in the sublingual space and opens into the mouth beneath the anterior portion of the tongue at a caruncle lateral to the lingual frenum. In its course the duct travels from lateral to medial and from below upward, corssing beneath the lingual nerve at the level of the third molar and then above the lingual nerve at about the level of the second molar. Thus, in a transoral procedure for removal of a stone, the lingual nerve would be encountered above the duct posteriorly but beneath the duct or not at all from the second molar forward.

The facial artery passes from behind and medial to the gland up and over the gland to emerge from the submandibular space laterally and proceeds into the face at the level of the anterior border of the masseter muscle. Thus the facial artery would not be encountered in the incision for removal of the gland but would have to be located by dissection. Its location is usually indicated by the presence of two lymph nodes, the prevascular and retrovascular nodes, which overlie it at the level of the inferior border of the mandible. Superior and deep to these nodes is the marginal mandibular branch of the seventh cranial nerve, and posterior to the nodes is the facial vein. Since the facial vein is lateral to the gland, this vein may be cut in the incision and cannot be depended on as a landmark once it has been disturbed.

Just medial to the course of the facial artery, at the superior pole of the gland and at the posterior border of the mylohyoid muscle, are several ganglionic connections from the lingual nerve. The submandibular ganglion is included in this plexus but is seldom identified at surgery. The lingual nerve may be identified above these connections and follows an anterior and medial course into the sublingual space in proximity to the submandibular duct.

The hypoglossal nerve and sublingual vein cross the lateral surface of the hyoglossus muscle in the medial wall of the submandibular niche. They are separated from the gland capsule by a thin layer of fascia, through which they may be identified, and therefore need not be disturbed. The hypoglossal nerve and sublingual vein, together with the posterior border of the mylohyoid muscle and the pulley of the digastric muscle, form a triangle having the hyoglossus muscle as its floor. By spreading the fibers of the hyoglossus muscle at this point, the lingual artery may be exposed.

Sublingual gland. The sublingual gland is a paired mucous gland lying in the sublingual space, above the mylohyoid muscle, in a line parallel to the course of Wharton's duct. Its landmark is a ridge called the *plica sublingualis,* which runs anteroposteriorly in the floor of the mouth. It secretes principally mucus from a series of small short ducts, which vary in number from person to person, and seldom becomes involved in the problems of its fellows, the submandibular and parotid glands. Occasionally glands normally occupying the anatomical position of the sublingual gland attach to the submandibular duct and open into it rather than into the mouth.

Minor salivary glands. The minor salivary glands are scattered throughout the oral mucous memberane and are simply clusters of mucous acini attached to short ducts that open into the mouth. They are sometimes clustered in groups, as are those beneath the tongue, and their ducts emerge in large numbers in relatively small areas. These glands are superficial,

lying just beneath the mucosa.

Microscopic anatomy

Microscopically these glands are all similar in construction, being composed of mucous or serous acini or combinations of both. The primary differentiating characteristic in any given fragment of tissue is the relative number of mucous or serous forms, the parotid gland being almost entirely serous.

Since the minor glands and the sublingual glands are simple systems, their epithelium-lined excretory ducts are small and short. The parotid and submandibular duct systems are composed of a series of small ducts that drain a single acinus and join to make larger ducts. These larger ducts drain lobes and in turn join the principal excretory duct to the mouth. Thus, if the ductal pattern were seen in its entirety, it would resemble a leafless tree with the termination of each twig an individual acinus, the branches the lobular ducts, and the trunk the main excretory duct.

The principal tissue elements seen microscopically are glandular epithelium representative of the secretory portion of the gland, cuboidal epithelium lining the ducts, connective tissue compartments dividing the individual lobes, and a capsule of connective tissue.

Anatomical weaknesses

Study of the salivary glands reveals several distinct anatomical weaknesses. The minor glands and the sublingual glands, having short, straight, simple duct systems, are seldom affected by inflammatory conditions but may react to anything causing partial closure or rupture of the duct. A mucocele is the usual result. Complete closure produces atrophy of the gland.

The other systems have more serious weaknesses. First, the entire submandibular gland and duct system lies in a dependent position, which predisposes it to retrograde invasion by oral flora. Second, both the submandibular duct and the parotid duct are slightly larger along their course than at their caruncle. This permits storage of secretions so that a ready flow may be available on stimulation without waiting for the secretory process. This relatively static reservoir, however, permits settling out of epithelial cells and inspissation of salivary fluids, which tend to form obstructions and are a ready nidus for bacterial activity. Third, both the submandibular and the parotid ducts make a radical turn along their course. The submandibular duct turns sharply at the posterior border of the mylohyoid muscle, just anterior to the hilus of the gland. The parotid duct turns sharply at the anterior border of the masseter muscle, fairly close to the caruncle. These two areas are favorite points for lodgment of obstructions, just as the mechanical aspects of the arrangement would suggest. Finally, since both glands are dependent on one mode of disposal of secreted fluids, anything tending to reduce the flow tends also to alter the composition and function of the glands.

Diseases of the Salivary Glands

Inflammatory diseases

Acute sialadenitis

Any acute inflammation of the salivary glands may be termed acute sialadenitis. What is discussed in this instance, however, is the nonspecific acute adenopathies not related to any other condition.

Symptoms. These swellings are usually sudden in onset, although they may be the acute phase of some chronic condition. The gland becomes sore and tense, usually on one side only, and pus may be seen at the orifice of the duct or may be milked from the duct system. The patient's temperature may rise, and the blood picture will reflect the relative toxicity of the infection. If uncontrolled, these infections will sometimes localize beneath the skin and require incision and drainage.

Etiology. Smears and cultures to determine the predominant organism reveal a wide range of bacteria, most of which are normally found in the oral cavity. These include *Streptococcus salivarius,* viridans streptococci, *Diplococcus pneumoniae,* and *Staphylococcus aureus.* Occasionally yeast forms are found. Thus evidence does not indicate any specific cause or predominant pathogen. Acute stomatitis seldom plays an appreciable role in the onset of such conditions.

Treatment. Treatment of these infections is by medicinal means. Antibiotics or sulfonamides to control the acute infection are indicated. If a sample of pus is obtainable, tests for specific antibiotic sensitivity are of great help. Care should be taken when making the culture to obtain the secretions of the duct rather than samples of the oral flora.

After the acute phases of the infection subside, or the patient is under adequate antibiotic control, the duct may be dilated with a blunt probe to assist drainage. Sialograms aid in assessing the cause or amount of damage and frequently are of great assistance in treatment because of the antimicrobial effect of the iodized solution used to make them. Adequate hydration of the patient is important, and the use of sialogogues to increase the salivary flow and produce a washing action may be beneficial.

Prognosis. Once established, this condition tends to recur. Frequently, the recurrent disease takes the form of a chronic or subacute type, and later in the course of the disease, obstructions may appear in the duct or cavitations may appear in the gland structure.

Differential diagnosis. Occasionally one sees conditions that may be confused with acute sialadenitis and vice versa. Unilateral epidemic parotitis, for example, is always a consideration in differential diagnosis. Often one sees cases of what has been termed idiopathic parotitis or submandibular adenitis for want of a better understanding of the condition. In these instances the gland has become hard and tender. No increase in temperature and no pus formation occurs. Sialograms reveal no evidence of disease, and the gland and duct substances appear normal. This condition is recurrent and subsides variously after administration of antibiotics, antihistaminics, or lemon drops, after massage, or on neglect. Two possible explanations have been advanced for this phenomenon: (1) that it is caused by the presence of small mucous plugs, which eventually pass out of the salivary caruncle when placed under enough pressure, and (2) that it is caused by the transmission of

noxious stimuli to the sympathetic nerves supplying the mucous acini, which produces hypersecretion of mucus and relative stasis as a result of increased viscosity.

Not infrequently the lymph nodes within the submandibular gland substance become enlarged. This enlargement may be accompanied by adenopathy of the adjacent prevascular and retrovascular nodes and is usually the result of infection higher in the head or jaws; still, it simulates inflammation of the submandibular gland. On palpation the vascular nodes can be separated from the gland and trapped against the mandible; however, the intraglandular node stays with the gland and is difficult to differentiate from glandular adenopathy except by the size and texture of the remainder of the gland. A similar situation obtains with the parotid gland, a frequent cause being minor infections of the eye.

Chronic sialadenitis

Any of the acute salivary gland infections just described may become chronic. The chronic disease, however, is most frequently found behind an obstruction that has produced long periods of stasis. In this condition the duct system dilates and exerts pressure against the adjacent gland. Obstruction and stasis increase the pressure and atrophy and fibrosis of the gland occur. The gland becomes firm and hard and may or may not be tender, depending on the phase of the inflammatory change and the degree of chronicity. Abscesses and cysts that require drainage may occur in the gland substance, or they may smolder for years in a series of remissions and recurrences. Conservative treatment in the form of removal of the obstruction, dilation of the duct, and diagnostic and therapeutic sialography may abate the condition. Unfortunately, recurrence is not unusual, and surgical removal of the gland may be necessary.

Chronic sialadenitis may also occur after long periods of general anesthesia, general debilitation, pneumonia, or other diseases involving high febrile courses, or any factor possibly tending to produce long periods of dehydration; all these permit bacteria to retrograde and incubate in the duct system. The resultant sialodochitis produces strictures of the duct, stasis, dilation, and chronic infection that resists permanent cure.

Diseases due to obstruction

Sialolithiasis

The series of events leading to both gross and microscopic chronic inflammatory changes in salivary glands is somewhat obscure. It is well known, however, that one of the most prominent signs is the production of a salivary stone, or sialolith. The most popular theory of sialolith formation is that an accretion of mineral salts forms in and around a soft plug of mucus, bacteria, or desquamated epithelial cells. This theory seems to be well founded in that some sialoliths are radiopaque and well calcified, whereas others are soft and rubbery and are not demonstrable radiographically. Sialoliths occur in a wide variety of sizes and shapes, a fact indicating that their development is progressive once they become lodged in the duct. The development of a sialolith inevitably leads to stasis and infection of the duct system and produces the changes described under chronic sialadenitis.

Symptoms. Symptomatically the gland involved may swell, especially at mealtimes, and may become tense and sore. This swelling and tenderness may subside, only to recur later. Pus may be seen at the orifice of the caruncle, which may be inflamed, and pus or cloudy saliva may be obtained by milking the gland. The stone may be palpable by bimanual

manipulation and may be movable up and down the duct. The stone may be visualized in radiographs, and dilation at the site of the stone and of the ducts of the gland will be evident in a sialogram.

Management. Management of these stones is surgical. Generally the stone can be removed transorally; however, extreme damage to the gland or recurrence of the disease after transoral removal of the stone may indicate removal of the gland.

Sialoangiectasis

This term is employed to describe a gland and duct system vastly dilated by stasis of salivary secretion resulting from obstruction. The most frequent cause is a sialolith, although a simple stricture may be the cause. It is not unusual to observe glands with a long history of chronic infection from no obvious cause that demonstrate this extensive dilation.

The prognosis for such glands is poor, since their natural history is one of repeated acute attacks, ultimately resulting in removal of the gland.

Retention cysts

Retention cysts result from rupture of a duct into the gland parenchyma. This rupture fills with salivary secretion and is eventually encapsulated with fibrous connective tissue. A complete or partial epithelial lining may or may not be present.

Since these cysts seal themselves off from the duct system, they do not fill with radiopaque contrast medium in sialography; instead, they demonstrate themselves radiographicallty as nonfilling, space-occupying defects in the gland substance. They may have an obscure opening into a duct that permits them to drain and refill periodically but that does not admit the radiopaque oil. For this reason, they are prone to enlarge and subside (a characteristic that readily differentiates them from mixed tumors, which do not subside). On palpation they are usually soft and may be doughy or fluctuant and they are sometimes tender. (Mixed tumors are hard and seldom tender.)

Treatment. Surgical removal is the treatment of choice. This is necessary not only to eliminate the lesion but to establish the diagnosis as well. Incision and drainage usually result in eventual recurrence. Exteriorization should not be considered.

Atrophy

Degree plays an important part in the effect of obstruction on glandular tissue. Partial obstruction results in sialoangiectasis; obstruction with rupture of the duct produces retention cysts; partial obstructions are usually accompanied by infection; and complete obstruction produces atrophy. Complete obstruction productive of atrophy is rare and is usually the result of surgical accident in which the main exretory duct is tied and all avenues for the escape of fluid are obliterated. Another prominent cause of salivary gland atrophy is heavy doses of irradiation, usually in the treatment of malignant tumors.

The loss of one salivary gland because of atrophy or excision is of little importance. The loss of several of the major glands, however, produces xerostomia and atypical caries. Lack of salivary secretion, collapse of the duct, and inability to receive iodized oil for sialography are typical of this condition. No treatment is available once the atrophy has

occurred.

Tumors of the salivary glands

Like tumors in most locations, primary tumors in the major and minor salivary glands can be roughly classified as benign and malignant. Even this classification will be disputed, since at least two tumors, the mixed tumor and the mucoepidermoid tumor, although benign in biological behavior at the outset, are well known to undergo malignant changes. In addition, at least one developmental defect, the branchial cleft cyst, so simulates a tumor clinically as to defy differential diagnosis short of formal biopsy. For this reason these tumors will be discussed according to their biological behavior when observed clinically. For a better understanding of these lesions, further study of the extensive literature on this subject should be carried out.

Benign tumors

Salivary adenoma. This tumor is a benign neoplastic proliferation of secretory cells in a salivary gland. It is usually confined to the substance of the parotid gland. It is firm, painless, usually well encapsulated, and slow growing, and it is readily moved from its growth site on pressure and returns to its original position on release. This is an important sign, since most malignant growths are indurated and cannot be displaced. Few, if any, visible changes appear in the sialogram, and differential diagnosis is not positive without biopsy. This tumor is regarded as biologically benign. Management is surgical.

Papillary cystadenoma lymphomatosum (Warthin's tumor). This benign and slow-growing tumor may occur anywhere in or near the parotid gland, usually in the region of the angle or ramus of the mandible or beneath the ear lobe. It is firm and non-tender and may be sufficiently circumscribed to be readily movable. Changes in the sialogram are minimal until the tumor has attained sufficient size to display non-filling, space-occupying, tissue-displacing tumor substance. Even then, differential diagnosis is questionable without biopsy. Warthin's tumor occurs most frequently in males in their fifth decade, but it may occur in either sex and somewhat earlier or later. Management is surgical.

Branchial cleft cyst. A branchial cleft cyst is a nonneoplastic and nonmalignant developmental anomaly, originating from epithelium that is enclaved between branchial arches at the time they fuse. It usually manifests itself as a swelling on the lateral aspect of the neck or in the floor of the mouth; but it is known to develop in sites adjacent to or within the major salivary glands, in such fashion as to defy differentiation from tumors of the gland by clinical means. A branchial cleft cyst is firm but softer, as a general rule, than any of the true neoplasms. Movement may be possible, but this is not always a characteristic, since the cyst may be attached to structures that move with difficulty, or it may have had a previous inflammatory episode that has produced circumferential fibrosis. During its tenure it may become tender to palpation, at which time it is usually tense and firm.

A branchial cleft cyst appears in the sialogram as a space-occupying, nonfilling defect, similar in many respects to other solid or cystic lesions of the salivary glands. Usually, however, it does not exhibit the typical "ball-in-hand" deformity comon to mixed tumors.

Mixed tumors. Wide disagreement is present among pathologists as to the essential nature of mixed tumors and among surgeons as to the proper method of treating them. For clinical purposes, the most arguable question is: Are they malignant or benign? Perhaps the

best way to answer this question for the clinician is to point out that since mixed tumors do not generally metastasize or, when untouched, do not invade until late in their development, they may be regarded as benign. Unfortunately, they have a strong propensity to recur. The recurrences are probably the result of either incomplete excision at operation or multicentric origin of the lesion; they are frequently more serious than the primary lesion because pathways of invasion are opened. Some say that a mixed tumor may undergo metaplasia after surgical intervention and recurs as a true malignant neoplasm. This theory leads to differences among surgeons, who variosly recommend enucleation, wide excision, or radical resection of the gland, seventh cranial nerve, integuments, and lymph node-bearing tissues that furnish drainage to the area. The best solution probably lies in the middle course, in which the lesion, together with a portion of the gland supporting it, is widely excised. It is seldom necessary to sacrifice the seventh cranial nerve in this procedure, and cure is the rule rather than the exception. When reoperation becomes necessary because of recurrence, seventh cranial nerve damage is more comon and the incidence of cure is reduced. This fact emphasizes the need for adequate management at the original operation.

Clinically mixed tumors are hard, probably, in part, because they are composed variously of epithelial and connective tissue elements. They are usually loosely encapsulated in fibrous tissue and are readily movable, although as they advance in size, involving more tissue, they may become firmly fixed and even give the impression of induration. Recurrences, on the other hand, almost without exception are firmly fixed. Mixed tumors are generally nodular to palpation and give the impression of being composed of one or more globular masses.

Mixed tumors occur most frequently in the parotid gland, usually at the angle of the mandible or beneath the ear lobe. They occur less frequently in the submandibular gland but occur often in the minor salivary glands of the palate and lips. (I have not encountered this tumor in the sublingual glands, although no reason is known why these should not be affected.)

Mixed tumors are painless and slow growing and are usually brought to the patient's attention by touch while shaving or applying make-up. Frequently, they are thought to be wens by the patient because of their proximity to a common epidermoid cyst-bearing area. For this reason some mixed tumors are large when first seen, whereas others are relatively small.

It is difficult to differentiate mixed tumors from the several other benign tumors of the area or from hyperplastic lymph nodes. Tissue examination is the most reliable method, and diagnosis can usually be rendered by means of frozen sectino, with sufficient accuracy to guide the surgeon in completing the procedure. In dealing with suspected mixed tumors of minor salivary glands, biopsy by total excision is the method of choice, since these lesions are usually of manageable size when first discovered. Sialography in problems of the minor glands is not useful.

Sialograms of major glands may show displacement of the glandular structure, particularly of the superficial lobe of the parotid gland. As a result of this displacement the collecting ducts curve around the lesion, giving the appearance of a hand carrying a ball. Unfortunately this characteristic is not limited to mixed tumors, and its presence requires that the tumor be of sufficient size to produce the deformity. For this reason, as with most tumors extrinsic to the duct system, sialograms are of limited benefit in the diagnosis of mixed tumors.

Treatment is always surgical. Since these lesions do not metastasize unless they have undergone metaplasia and are behaving like a true malignant tumor, dissection of the lymph node-bearing area appears to be excessively radical. On the other hand, in view of the well-known tendency toward recurrence, an original attempt at enucleation seems dangerously conservative. Thus wide, adequate excision of the area, with efforts toward preservation of vital structures, seems the technique of choice. Mixed tumors do not respond to irradiation.

Neurilemmoma (schwannoma). Neurilemmoma is included in this discussion, not because it occurs in salivary gland tissue, but because it occasionally affects branches of the seventh cranial nerve and because it bears such a similarity to mixed tumors clinically that differentiation is almost impossible.

This tumor is benign, slow growing, and aysmptomatic. It is encapsulated and readily movable.

No sialographic findings appear until the tumor reaches a large size; then the sialogram shows displacement of gland substance, similar in all respects to that of the mixed tumor.

The primary problem inherent in a tumor of this type is its removal. A neurilemmoma is firmly attached to the sheath of the nerve that it involves, and although the tumor has no special effect on the function of the nerve, its removal usually results in damage or section of the nerve at the point of atachment. Since this lesion does not ordinarily undergo malignant transformation, it would be better left alone if the diagnosis of neurilemmoma were established. All too often, however, the damage to the nerve occurs at the time of investigation, and the diagnosis arrives too late. A neurilemmoa does not respond to irradiation.

Malignant tumors

Mucoepidermoid tumors. Mucoepidermoid tumors have been variously subdivided in the past into two groups, malignant and benign. Even now, reasons seem adequate to believe that some are of a higher degree of biological activity than others and therefore more malignant than others. The class in general, however, is malignant and should be regarded and treated as such.

Mucoepidermoid tumors may grow either rapidly or slowly. They seldom exhibit pain unless infection or invasion of vital structures occur. They occur most frequently in the parotid gland but may occur anywhere salivary gland tissue exists. On palpation they feel firm, indurated, and bound down to the surrounding structures; they do not move readily.

Since mucoepidermoid tumors involve the ductal and acinar structures of the gland, changes may be observed in the sialogram. Evidence of cavitations may appear where necrosis has occurred or of hyperplastic glandular activity with new duct formation or of a stricture caused by the filling of a duct with neoplastic tissue. Because any of these findings may also be typical of inflammatory disease, care should be taken to coordinate the clinical and sialographic findings accurately before risking a diagnosis. In the final analysis, tissue examination is the only method by which an accurate diagnosis may be reached.

Treatment of these tumors is surgical. Resection may of necessity be more radical than in the mixed tumors, depending on the extent of the tumor. Conservative management of the

seventh cranial nerve must not be considered important; instead, the surgeon should be governed by the extent to which the lesion has invaded adjacent tissue. This is not to imply that the nerve must always be sacrificed. If conservation of the nerve jeopardizes a surgical cure, however, sacrificing the nerve is indicated. Radical neck dissections are not generally indicated unless evidence exists of regional node metastasis, although some schools of thought regard prophylactic neck dissection at the original operation as the mode of choice.

Irradiation may be of benefit in controlling metastasis or in palliative therapy, but it is not thought by most to afford a cure or to be indicated as a postsurgical prophylaxis.

Squamous cell carcinoma. Like the mucoepidermoid tumors, squamous cell carcinomas originate from the epithelium lining the salivary glands and ducts. Unlike the mucoepidermoid tumors, however, no doubt exists about the malignancy of carcinomas, only about the relative degree of their malignancy. Although it is thought that these tumors probably originate within the ducts, invasion of the surrounding glandular tissue occurs promptly. Metastasis to the regional lymph nodes may occur early or late, depending on the individual behavior of the tumor.

The symptoms, signs, and sialographic evidence of these tumors are similar to those of mucoepidermoid tumors, and no clear-cut clinical differentiation may be made.

Treatment is also similar in all respects, with radical neck dissection figuring more prominently in the treatment by most surgeons.

Irradiation has a noticeable effect in the control of these lesions and their metastasis, particularly in the control of the more anaplastic types. However, control and palliation, rather than cure, are the usual goals of irradiation.

Adenocarcinoma. A large number of lesions, bearing an even larger number of names and subclassifications, may be grouped under the general heading of adenocarcinoma. Included in these are the pseudoadenomatous basal cell carcinoma (adenocystic basaloid mixed tumor or cylindroma), papillary adenocarcinoma, serous cell adenocarcinoma, mucous cell adenocarcinoma, malignant oncocytoma, and malignant mixed tumor. These and many other terms serve largely to confuse the clinician. For the sake of clarity in thinking of these lesions, it should be understood that all are malignant, all are potential killers, and all require some form of radical surgery or cancericidal irradiation if they are to be cured.

The symptoms of these lesions, with the notable exception of cylindroma, are generally those seen in mucoepidermoid tumor and squamous cell carcinoma. A cylindroma is usually a slow-growing lesion, and its mild-appearing histological characteristics and growth history may lead the surgeon to believe that it is not an aggressive lesion. Actually, it has a powerful propensity for recurrence and extensive invasion with local destruction, frequently leading to successive, disfiguring operations and ultimately metastasizing to distant sites late in the disease.

Other adenocarcinomas may grow with great rapidity and may be so anaplastic in their microscopic characteristics as to defy subclassification.

Sialographic identification of an adenocarcinoma is questionable, since the appearance of its internal structure may be similar to that of any other lesion that produces spaces resulting from central necrosis. In some of the more slowly growing tumors, however,

attempts by the tumors to form tissue morphologically similar to the parent tissue produce abnormal acinar structures that are capable of receiving the iodized oil and simulate hypertrophic glandular substance.

The treatment of choice is usually radical surgery. Radical neck dissection may be performed when indicated.

Irradiation is effective in individual cases but by no means effective in all cases. Cylindroma in particular is radioresistant. If the tumor is accessible to effective irradiation, it is usually accessible to surgery. For this reason, irradiation is usually reserved for control, palliation, and, in some cases, prophylaxis rather than for primary treatment - the condition and life expectancy of the patient and the size, grade, and location of the lesion all being factors for consideration.

Differential Diagnosis of Salivary Gland Lesions

A principal problem associated with the treatment of salivary gland lesions is the decision of the clinician regarding the type of lesion being treated and its anatomical location in relation to the various associated structures. Cytological examination is becoming increasingly important in diagnosis because of improvements in technique and understanding of the specimens obtained. The validity of this examination and of needle biopsy depends largely on the accuracy of the technique by which the tissues were obtained and on the training and ability of the pathologist responsible for analyzing the tissues. Formal biopsies are dependable, but they involve openings on the face and are contraindicated in inflammatory diseases. It rests with the clinician to decide with the nonsurgical means at hand what, if any, further steps are required to secure an accurate diagnosis. The means available are principally the history, the physical examination, and the radiographic examination. From these a rational course of treatment or further diagnostic needs can be determined. Occasionally clinical laboratory examinations may aid in making the decision.

History

A history of the lesion concerned frequently aids in the determination of its nature.

Duration. The duration of a lesion is an important factor. If a lesion is old and has a history of remission and exacerbation, it is probably of an inflammatory nature. If it is old and has a history of slow, steady growth, it is usually a benign or low-grade malignant tumor. If it is a new lesion with acute symptoms, inflammation is suggested. A new lesion with a painless swelling, however, is suggestive of early malignancy.

Nature of onset. The nature of the onset may offer some clue. If the onset is gradual and painless but continuous, tumor is suggested. If it is sudden and painful, the diagnosis of inflammation is more proper, although rapidly growing tumor with overlying infection cannot be discounted.

Rapidity of growth. The rapidity of growth is an important diagnostic point and indicative of the degree of malignancy. A slow but continuously growing lesion is seldom inflammatory or of a high grade of malignancy. A rapidly growing lesion may be either; but pain, exudate, inflammation, fever, or alterations in the differential blood count toward immaturity usually accompany inflammations. (It is to be remembered that tumors as such are not painful until they either invade surrounding sensitive structures or become infected.)

Rapidly growing lesions with a history of resolution and remission are odds-on favorites to be inflammations. Slowly growing lesions with a history of remissions are usually cysts or other retention phenomena. It is not typical of any true neoplasm to remit or regress, although some will have periods of biological inactivity.

Coincidental conditions. A history of other conditions coincidental to the present complain frequently offers a clue or an explanation of the problem. A history of juvenile tuberculosis or tuberculosis in the family may explain the presence of a calcified body in the region of a salivary gland when no connection with the gland is demonstrable. A history of pneumococcal pneumonia or other acute febrile disease may mark the beginning of chronic sialadenitis, particularly of the parotid gland. Long general anesthesias, usually with the employment of antisialogogues, are pertinent to the observation, as would be the coincidental presence of any cachectic or dehydrating condition.

Physical examination

A proper physical examination is the most important single factor in the differential diagnosis of any given condition. In addition to a general physical survey to detect systemic factors that might be contributory, a careful appraisal of the adnexa of the glands should be carried out. It is important to remember that both the submandibular and parotid glands have adjacent lymph nodes and nodes within the glandular structure itself. Adjacent infections or tumors in the drainage areas of these nodes frequently cause swellings that only appear to be primary in the glands. Typical of such infections are those of the eye that produce enlargement of the parotid nodes or those of the teeth that cause enlargement of the submandibular nodes. Tumors of the facial skin such as melanoma, of the oral cavity, and of the facial structures may all produce enlargements of the lymph nodes of the head and neck. Metastasis from more distant parts is relatively rare, although involvement of these nodes by malignant lymphomas is common.

Bimanual appraisal of these lesions is a necessity, and much information can be transmitted to the examining finger. Manual examination is correctly done by placing one finger into the mouth and the opposite hand over the lesion. Careful manipulation with both hands is calculated to estimate the following circumstances.

Location of the lesion. Ductal lesions are best palpated from within the mouth when the lesion is in the submandibular duct or in the anterior third of the parotid duct. Lesions in the hilus of the submandibular gland just superior to where it passes beneath the mylohyoid muscle are also best palpated from within the mouth. Most salivary stones fall into this category.

Lesions lateral to the musculature of the mouth can be displaced laterally by the intraoral finger and can be more readily felt by the extraoral hand. Portions of the gland itself can be displaced and its texture more readily felt. Nodes and swellings can be fixed and identified. Lesions not palpable or movable from within the mouth are then better related as to the relative position they bear.

Milking the gland and duct bimanually offers an estimate of the nature of the secretion and hence of the location of the lesion. Extraductal lesions seldom produce pus within the duct system unless they are so far advanced as to occlude the ducts by pressure.

Consistency of the lesion. Circumscribed lesions such as mixed tumors, enlarged inflammatory nodes, and schwannomas are readily movable. The inference from this phenomenon is that the lesion has not invaded surrounding tissues and is not surrounded by diffuse inflammatory exudate. Acutely inflamed areas, abscesses, invasive malignant tumors, or their lymphatic spread are not readily movable, a result of the infiltration of the surrounding tissues by the disease. An exception is the lymph node involved in early metastasis that has not yet lost its capsular integrity.

Indurated lesions bear a graver prognosis. Although the primary differential sign between a malignant lesion and an indurated inflammatory lesion is the presence or absence of pain, this sign is not always dependable, since overlying infection may be involved in any advanced malignant growth. In general, however, induration and boardlike hardness of the area in question is a grave sign, particularly if the cardinal signs of infection are absent or not in proportion to the extent and history of the change. Induration is typical of invasive malignant lesions, and this sign must be considered diagnostic until proved otherwise.

Consistency of the remainder of the gland is essential. Malignant lesions rarely involve the entire gland unless they are infected or far advanced. Thus a portion of the gland should feel normal to the examining hand. Infections, conversely, usually produce tenseness throughout the entire gland, as does ductal obstruction.

Separation of the gland from lesions not actually involving the gland is also an important sign. In many cases, swellings may seem to involve the gland, but palpation and fixation by finger pressure of either the gland or the lesion demonstrate that the lesion bears only an anatomical rather than a histological relation to the gland. This characteristic is particularly true of branchial cleft cysts, dermoid cysts, nodes, and inflammatory swelling primary in the teeth. In these cases the consistency of the uninvolved gland will be normal.

Many conditions have a typical consistency. Abscesses are usually fluctuant; dermoids and other thick-walled cysts are usually doughy; stones are dense and may be stellate; and infected or obstructed glands are usually firm and tense. It becomes obvious that the consistency of the lesion is an important differential sign.

Subjective response. The subjective response of the patient to the bimanual examination frequently varies in accordance with the nature of the disease. Inflammatory conditions are usually accompanied by pain. This pain is increased with manipulation and is reliable. At the risk of repetition, it should be remembered that tumors that have become infected or have invaded sensory nerve-bearing structures may also be painful, but that pain is usually a late rather than an early sign of malignancy.

Benign tumors, low-grade malignant tumors, and early malignant tumors are seldom painful. Manipulation may be carried out without complaint from the patient until it has continued long enough to become nettlesome.

The tissues overlying a salivary stone, on the other hand, are almost always tender because of the incompressibility of the stone, the sharp processes sometimes present, and the inflammation occurring in the ducts surrounding it.

Radiographic evaluation

Ordinary radiographs are of little value except in the presence of a calcified stone or advanced invasion of nearby bony structures. For this reason routine radiography may be omitted unless the examiner has reason to suspect one of these conditions. When a salivary stone is suspected, the mandibular occlusal and the lateral oblique jaw views are of the most value in locating submandibular stones. The posteroanterior and lateral views of the face, coupled with an occlusal film placed in the buccal parietes and shot with a very short (0.5 to 0.75 second) exposure, may be of value in locating parotid stones. A submentovertex view outlining the zygomatic arch may also be useful.

The sialogram offers more diagnostic information. This special study is carried out by instilling radiopaque oil into the duct system of the gland and taking such views as are indicated. Many techniques and forms of equipment to accomplish this study have been described. One that I have found successful is illustrated.

Materials. The following materials are required:

1. Several sizes of polyethylene tubing about 18 inches in length, one end of which has been sharply and smoothly beveled.

2. A Luer-Lok connector of the type employed in continuous spinal anesthesia.

3. A ring-handle 3 mL Luer-Lok syringe.

4. A broken explorer, the end of which has been rounded and polished, to be used as a dilator.

5. Any radiopaque oil contrast medium.

Method. A length of polyethylene tubing of suitable caliber is selected and fitted into the connector. The syringe is filled with contrast medium and attached to the connector. All air is removed from the system. Extra oil will serve as a lubricant.

The syringe is detached, and the duct in question is cannulated. If pain is encountered, a few drops of local anesthetic around the caruncle may be used. If cannulation proves difficult, the explorer may be introduced to dilate the duct opening. Factors leading to difficulties in cannulation are as follows:

1. Too large caliber tubing.

2. Rough bevel on tubing.

3. Short or blunt bevel on tubing.

4. Lack of lubrication on tubing.

The tubing is inserted well into the duct. In the parotid duct an anatomical block is usually encountered where the duct turns posteriorly around the anterior border of the masseter muscle. In the submandibular duct a distance of 3 to 4 cm is usually sufficient.

The patient is then asked to close his mouth, and the tubing may be held in place through any convenient embrasure without being crushed. The syringe is reconnected, and the patient is instructed to hold it against his chest. In this way, the patient may be moved and positioned at the convenience of the radiologist. When the radiologist has positioned the patient satisfactorily, injection of the contrast medium is started. The patient is instructed to raise his hand when pressure is felt and again when definite pain is felt. Amounts of solution used are subject to individual variaiton, and symptomatic filling is usually more reliable than predetermined amounts.

Pressure is maintained for 10 seconds after pain is elicited, and then the sialogram is taken. Light pressure is maintained during repositioning for additional views. Posteroanterior and lateral skull views may be taken at the discretion of the operator.

After all views are taken, the tubing may be removed, and the patient is instructed to assist in emptying the gland by massage. Residual oil in the gland and duct system is not harmful and may be beneficial in some low-grade inflammatory conditions.

A great deal may be learned from the sialogram, especially if the information is accurately integrated with the clinical findings. Not all lesions have typical sialographic findings, however, and in many cases the final diagnosis depends on formal biopsy techniques. Fortunately, most inflammatory conditions display fairly typical findings when these are coupled with the clinical course, whereas tumors are frequently characterized by the singular absence of sialographic evidence. An example of misinterpretation of equivocal findings is seen.

Sialographic interpretation is best studied by integrating sialographic findings with clinical and historical findings and a knowledge of the basic anatomy and pathologies of the region. For this purpose a group of typical cases is presented in which the sialographic findings and the clinical and historical findings were sufficiently clear to reach an accurate diagnosis.

Laboratory procedures

Several laboratory procedures are useful in the differential diagnosis of salivary gland lesions. Mumps, infectious mononucleosis, and acute sialadenitis, which tend to resemble one another in the early stages, may be differentiated by an examination of the blood and blood serum. Infectious mononucleosis usually displays a high percentage of atypical lymphocytes as well as an increased overall lymphocyte count in the blood examination. Sialadenitis, if acute, may show an increase in the number of immature polymorphonuclear leukocytes in the blood examination. A heterophil agglutination test of the blood serum is of benefit in distinguishing infectious mononucleosis.

Most laboratories regard cytological smears as undependable inthe differentiation of extraductal salivary gland lesions. Aspiration or needle biopsies are difficult to read because of the small amounts of tissue they offer. Frozen sections and formal biopsies, however, are highly dependable and complete the generally used clinical laboratory examinations.

A complete blood count and a differential blood count may offer some clue as to the relative toxicity of the disease, but they are in no way specific, since they demonstrate only the blood's response to an infectious process.

Cytological examination may be carried out if malignant involvement of the duct system is suspected. It is to be remembered, however, that simple saliva from the mouth is not a useful sample, and material for this examination should be obtained from the duct of the suspected gland by cannulation. The applications of this examination are limited, and, if results are negative, they are by no means conclusive.

Smears, cultures, and antibiotic sensitivity tests are valuable when the type of organism and the specific antibiotic to be employed are at issue. Again, the sample must be taken from the cannulated duct to avoid oral contamination.

Surgical Procedures

With the possible exception of the surgical management of retention cysts such as mucoceles and ranulas, the transoral sialolithotomy is the most frequent operation performed on the salivary system. It is a simple operation, frequently overlooked by medical practitioners untrained in oral surgery in favor of enucleation of the gland. If the stone is favorably located, its removal through the mouth preserves the gland and hence the function of the gland. Although sialoliths are known to recur and glands may be so badly damaged by infection as to require subsequent or eventual enucleation, the more conservative course is usually indicated at the original operation because of its widespread success in the hands of most operators.

The submandibular gland can be enucleated without sequelae if the operation is properly accomplished. Before removing this gland, however, thought should be given to the results of the loss of its function, although in most patients with normal salivary secretion in the remaining glands, its removal is of no consequence.

Removal of the parotid gland is of greater consequence. Danger to the seventh cranial nerve is always present, although careful surgery permits the removal of this gland with only transient weakness in most instances.

The removal of either gland results in slight facial deformity. In the case of the submandibular gland a scar plus a depression or, more accurately, a lack of fullness in the submandibular region results. When the parotid gland is involved, a retromandibular scar plus a loss of some facial contour is experienced. These factors are not significant if the operation is necessary but contraindicate such procedures when conservative methods would suffice.

Transoral sialolithotomy of submandibular duct

Transoral sialolithotomy is best done with the patient under local anesthesia and in a sitting position.

The stone is first located accurately by radiography and palpation. If possible, and especially if the stone is small and smooth, a suture is passed through the floor of the mouth, below the duct and behind the stone, and tied to prevent the stone from sliding backward. A towel clamp is placed through the tip and, if necessary, the side of the tongue to obtain retraction and control of this member. This step is especially important in obese persons or in those who are unable to control their tongue voluntarily. In slim or especially cooperative persons the tongue can be held in a gauze sponge. How the tonque will be retracted and controlled should be determined at the time of examination, but towel clips should be included in the armamentarium in any case.

The gland is then palpated extraorally and pushed upward toward the floor of the mouth to fix the intraoral tissues under tension and make the stone easier to palpate.

When the incision is made, consideration is given to two structures, the lingual nerve and the sublingual gland. Posteriorly the lingual nerve is superior and lateral to the duct, crossing beneath it at the posterior end of the mylohyoid ridge and passing medially and deep. Thus, if the stone is posterior, the incision is shallow and blunt dissection is employed immediately to prevent injury to the lingual nerve. If the stone is more anterior, the incision must be made medial to the plica sublingualis, or the operator will find the subglingual gland between his instrument and the stone, and a portion of the gland will be transected. Thus the incision for an anterior stone is designed to be over the stone and medial to the plica.

As soon as the operator progresses through the mucosa, blunt dissection is used. Both the incision and the opening obtained by spreading the tissues should be large enough to permit the entrance of the examining finger, since reorientation is frequently necessary. Dissection is continued bluntly through the loose tissues of the space until the duct is encountered. If the lingual nerve is encountered in the incision, it must be retracted gently but never cut. Bleeding is seldom a problem, but, if it occurs, it should be controlled by ligation before proceeding.

The duct is best identified at the point where the stone is lodged. If difficulty arises at this tage, a probe may be passed into the duct to aid in its location. When the duct is located, a longitudinal slit is made directly over the stone. The duct should not be cut transversely because retraction may complete the division and a fistula may result. The opening should reveal the stone and should be of sufficient length to permit its removal. The stone can usually be carefully removed with small forceps, but large stellate stones may have to be broken by crushing them with a forceps. After the stone is removed, a small aspirating cannula may be passed toward the gland to remove any pus, mucous plugs, or satellite stones that remain. A probe is then passed from the caruncle to the surgical opening to ensure patency of the anterior end of the duct.

No effort is made to close the duct proper. The wound edges are sutured at the level of the mucosa only, and recanalization occurs without further intervention.

Transoral sialolithotomy of parotid duct

The approach to calcifications in the parotid duct may be more difficult than to similar lesions in the submandibular duct. The reason for this is the anatomical peculiarity of the parotid duct. After following a short, superficial course from its caruncle, the parotid duct turns laterally and rounds the anterior border of the masseter muscle, proceeding posteriorly to joint the gland. A direct cut-down on stones in this duct therefore is possible only when the stone is anterior to the anterior border of the masseter muscle. Since most parotid duct stones lodge at or posterior to this point, a direct cut-down is seldom effective. Splitting the duct to follow the channel posteriorly frequently so damages the duct and caruncle that strictures are produced, which lead to new stasis and stone formation.

The suggested procedure therefore involves making a semilunar incision running from above downward in front of the caruncle. The caruncle, mucosal flap, and duct are then retracted medially, the cheek is retracted laterally, and free access is gained to the more posterior segments of the duct by simply following the duct with blunt dissection. This procedure also permits the duct to be retracted anteriorly so that the stone can be delivered

into the wound. When the stone becomes accessible, a longitudinal incision is made in the lateral side of the duct, and the stone is delivered. The duct need not be sutured, since simply closing the mucosal flap with deep mattress sutures will serve to produce recanalization of the duct.

Removal of submandibular gland

Occasionally, because of previous damage from stasis and chronic infection, removal of the submandibular gland is necessary. Usually this is not done until conservative means have been exhausted.

The extraoral incision parallels the course of the digastric muscle. To determine this course, the surgeon palpates the mastoid eminence, the lateral surface of the hyoid bone, and the genial tubercle. A curving line connecting these three landmarks represents the course of the anterior and posterior bellies of the digastric muscle. A 5-cm incision is made along this curving line directly over the inferior pole of the gland, and the platysma muscle is sectioned.

The first structure encountered is the facial vein, which is ligated and cut. At the level of the deep fascia the cervical ramus of the seventh cranial nerve is encountered where it communicates with superficial cervical nerves from the cervical plexus. This ramus can usually be retracted posteriorly by passing a hernia tape around it, although cutting it represents no serious loss, since it provides only partial innervation to the platysma muscle on one side only.

Beneath the fascia lies the submandibular niche. Blunt dissection between the pulley of the digastric muscle and the gland will free the anterior and inferior portions of the gland. The dissection is continued around the posteroinferior pole, leaving the superior and medial portions of the gland attached.

Vital structures to be considered at this point are the facial artery, the lingual nerve, and the submandibular duct. The facial artery curves up and over the superior aspect of the gland and emerges on the lateral side of the mandible at the anterior border of the masster muscle. This artery can usually be located by the presence of the prevascular and retrovascular lymph nodes that lie on either side of the vessel. In most instances it is wise to identify and double ligate the facial artery below the gland and to separate it before proceeding with the dissection because its connections with the gland are usually short and difficult to tie and the vessel is frequently buried within the gland.

The gland may then be retracted posteriorly and detached from its ganglionic connections with the submandibular ganglion. The lingual nerve can be identified at this point, but the ganglion is seldom seen at surgery.

As the dissection proceeds bluntly, the submandibular duct may be noted passing superiorly and anteriorly over the roof of the submandibular niche, which is formed by the mylohyoid muscle. This muscle should be retracted anteriorly, the duct retracted posteriorly, and a ligature placed anterior to the ductal pathology if such exists. A second ligature is placed posterior to the first but still anterior to the ductal pathology, and the duct is section between the ligatures. This procedure prevents seepage of infected material into the wound from either the residual duct or the gland. The gland may then be removed and consideration given to the closing of the wound.

Dead space resulting from removal of the gland must be closed or drained. Closure can usually be accomplished by approximating the fasciae of the digastric, stylohyoid, hyoglossus, and mylohyoid muscles with absorbable catgut sutures. If this cannot be done and a dead space remains, or if it is believed that the crypt has become contaminated or is infected, a Penrose drain should be inserted into this area. A second layer of absorbable sutures should be used to close the deep fascia and platysma muscle. A third layer of subcutaneous or subcuticular absorbable sutures is used to close the skin, and the skin edges are then carefully approximated with interrupted silk sutures, size No 4-0 or smaller.

The wound should always be covered with a pressure dressing. The drain, if one is placed, should emerge from the wound at the most dependent point, which is usually at the posterior aspect of the wound. This drain may be removed after 24 to 48 hours if no suppuration is present. After 4 days the pressure dressing may be discontinued and half of the sutures may be removed. The incision should be bridged with adhesive butterflies or with a firm collodion dressing. The remaining sutures may be removed on the fifth to seventh day, but the wound should continue to have bridging support for at least 2 weeks.

Removal of parotid gland

In general, removal of the parotid gland is not considered to be within the purview of the oral surgeon. By virtue of special training or because of local circumstances, however, the oral surgeon may include this operation in his or her repertoire. In any case the surgeon should have some knowledge of the problems involved in order to make decisions regarding treatment.

Because of certain inherent risks of permanent damage to the seventh cranial nerve, this operation is not usually done without strong indications. The presence of a tumor or suspected tumor or of chronic inflammatory disease resistant to conservative treatment is the primary reason for such an undertaking. Most surgeons make every attempt to conserve the seventh cranial nerve by careful dissection or partial removal of the gland. A malignant lesion, however, suffers not compromise, and when attacked surgically, it must be extirpated without regard for the possible resultant deformity.

The incision runs from the superior attachment of the pinna downward, turns anteriorly at the angle of the mandible, and stops at the hyoid bone. A second incision, which may be made posterior to the pinna, joins the first at the inferior margin of the pinna. The ear is retracted from the operative field, and the skin flap is developed on the cheek side of the incision.

The facial nerve may be located in either of two ways: (1) by finding the peripheral portion where it emerges from the anterior edge of the gland and then dissecting backward or (2) by dissecting directly down the posterior aspect of the gland and identifying the main trunk between its entrance into the gland substance and the stylomastoid foramen. An electric stimulator is of great assistance in this maneuver. After the nerve has been identified, the course of the trunks is followed and the superficial lobe is freed from its attachments. The duct is ligated and cut. Some of the smaller connections between the main trunks may be destroyed in this process, with resultant postoperative facial weakness. Preservation of the main branches of the nerve, however, ensures eventual return to full function.

After the superficial lobe of the gland has been freed and the main branches of the facial nerve have been identified, the deep lobe may be approached. This lobe wraps around

the posterior border of the mandible, and dissection in this confined space is facilitated by posterosuperior retraction of the ear. Care should be taken to protect the external carotid artery and the retromandibular vein during this operation. Ligation of these vessels may be prudent because either or both of them may be embedded in the gland substance in a part of their course and because hemorrhage from the rather large maxillary branch of the external carotid artery may be difficult to control as a result of its relative inaccessibility.

The parotid capsule is tough along its posterior attachment, particularly where the gland encounters the sternocleidomastoid muscle and the acoustic meatus. Care must be exercised, while the pinna is retracted, not to incise the acoustic meatus during separation of the gland.

Most dead space may be closed by careful suturing after removal of the gland. A drain may be indicated in the wound, especially if a portion of the gland is removed and salivary accumulation is expected.

Conclusion

An essential part of the mission of oral surgery is the diagnosis and treatment of certain diseases of the salivary glands. Careful diagnosis is the key to success and usually indicates the method of treatment. The ability to distinguish those diseases and conditions the treatment of which is a part of oral surgical training and those the treatment of which is within the province of one of the medical specialties is of paramount importance. A knowledge of the anatomy of the salivary glands, an adequate examination, a thorough history, and diagnostic radiographs are a necessity. Clinical laboratory procedures may be of some assistance. Formal biopsy is the only sure method of establishing a firm diagnosis when a malignant condition cannot otherwise be ruled out.